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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/812,734	03/30/2004	Shau-Lin Shue	TS00-101C	4809

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EXAMINER	
SMITH, BRADLEY	

ART UNIT	PAPER NUMBER
2891	

DATE MAILED: 05/16/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

SM

Office Action Summary	Application No.	Applicant(s)	
	10/812,734	SHUE ET AL.	
	Examiner	Art Unit	
	Bradley K. Smith	2891	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *24 February 2005*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *32-62* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *41-48 and 58-62* is/are allowed.

6)☒ Claim(s) *32-40 and 49-56* is/are rejected.

7)☐ Claim(s) *57* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *03 March 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☒ Certified copies of the priority documents have been received in Application No. 10/207548.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 32, 33, 35, 40, 49, 50 and 52 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ding et al. (US Patent 6,387,805) in view of Adams et al. ("Titanium-nitride self encapsulation of Cu and Ag films on silicon oxide"). Ding et al. disclose an insulating layer over the substrate, an opening in the insulation layer on the substrate, a fill layer of Cu-Ti over the insulating layer (see column 7). With regards to claims 33, and 50 form a barrier layer over the insulating layer, and under the fill layer with Ti (see column 7). With regards to claims 35, 43, and 52 Ding et al. disclose the formation of an oxygen rich titanium layer (column 6 lines 50-55). With regards to claims 40, 48 and 49 Ding et al. disclose titanium is distributed uniformly in the copper fill. However Ding et al. fail to disclose the self passivation layer comprised of titanium nitride over the fill layer. Whereas Adams et al. disclose the nitiridation of a copper titanium layer to form titanium nitride. Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made combine the teachings of Ding et al. and Adams et al., because the titanium nitride layer would protect the copper layer and it would be easier to nitridize the copper titanium layer than to deposit a blanket layer of titanium nitride over the whole substrate.

3. Claims 32, 33, 37-39, 49, 50, and 54-56 are rejected under 35 U.S.C. 103(a) as being unpatentable over Jiang et al. (US Patent 6,693,356) in view of Adams et al. ("Titanium-nitride self encapsulation of Cu and Ag films on silicon oxide"). With regards to 32, and 49 Jiang et al. disclose an insulating layer over the substrate, an opening in the insulation layer on the substrate, a fill layer of Cu-Ti over the insulating layer. With regards to claims 33, and 50 Jiang et al. disclose a barrier layer between the insulation layer and the fill layer. With regards to claims 37-39, 54-56, Jiang et al. discloses a tantalum nitride barrier layer with a thickness of 1nm-50nm (see column 4 lines 35-50). However Jiang et al. fail to disclose the self passivation layer comprised of titanium nitride over the fill layer. Whereas Adams et al. disclose the nitiridation of a copper titanium layer to form titanium nitride. Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made combine the teachings of Jiang et al. and Adams et al., because the titanium nitride layer would protect the copper layer and it would be easier to nitridize the copper titanium layer than to deposit a blanket layer of titanium nitride over the whole substrate.

4. Claims 34, 36, 51 and 53 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ding et al. (US Patent 6,387,805) in view of Adams et al. ("Titanium-nitride self encapsulation of Cu and Ag films on silicon oxide") as applied to claims 32, and 49 above, and further in view of Gabriel et al. (US 6,472,231). Ding et al. and Adams disclose the providing an insulating layer over the substrate, an opening in the insulation layer on the substrate, a barrier layer over the insulating layer, a fill layer of

Cu-Ti over the insulating layer. However with regards to claims 36, 53, Ding et al and Adams et al. fail to disclose the formation of a dual damascene structure. With respect to claims 34, and 51 Ding et al and Adams et al. fail to disclose the low-k dielectric insulation layer. However Gabriel et al. disclose the use of both the low-k dielectric insulation layers and a dual damascene structure (column 1 and column 3). Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to combine Ding et al and Adams et al. with Gabriel et al., because the use of the elements is common in the art (it was described in Gabriel's background of the invention).

Allowable Subject Matter

5. Claim 37 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

6. The following is a statement of reasons for the indication of allowable subject matter: : the prior art of record fails to teach or suggest within the context of the entire claim, wherein the fill layer has a Ti concentration ranging between about 0.1 and 2.0 weight percent..

7. Claims 41-48 and 58-62 are allowed.

8. The following is a statement of reasons for the indication of allowable subject matter: the prior art of record fails to teach or suggest within the context of the entire

claim, wherein the fill layer has a Ti concentration ranging between about 0.1 and 2.0 weight percent.

Response to Arguments

9. Applicant's arguments filed 2/24/05 have been fully considered but they are not persuasive. With regards to the applicant's arguments regarding Ding and Adams the applicant alleges "The present disclosure provides a self-passivation layer disposed over the copper titanium alloy layer, wherein the self-passivation layer comprises titanium nitride and the insulating layer does not necessarily have silicon and oxygen" the examiner understands the applicant to be stating that one would not be able combine Ding because of the insulating layer. In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). Furthermore the applicant goes on to allege that the combination of would not work due to the method of forming the device (the method of making is patentably distinct and the reason why the applicant received a patent 6,716,753), and the examiner contends that one of ordinary skill would be able to alter the conditions in order to form the desired structure in order to make the device cheaper and faster.

10. With regards to the applicant's arguments regarding the combination of Jiang and Adam the applicant once again tries to import method limitations into a device

claim, by stating that Jiang uses a two step fill procedure. With regards to the applicant's contention that copper titanium is not a preferred choice the examiner points out that copper titanium is disclose and a viable option. Lastly once again the applicant alleges that the two references could not be used together, because they are formed in over a different surface. The examiner contends that one of ordinary skill would be able to combine the references in order to form the desired product once again the examiner would like to point out that one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.,* 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

11. Regarding the applicants last argument that Ding, Adams and Gabriel could not be used together to form the device the examiner contends once again that the combination teaches all the limitations and that one of ordinary skill would have motivation to make the desired structure.

Conclusion

12. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

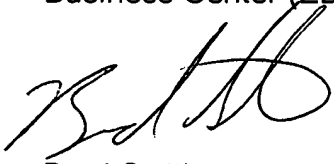
A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the

shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Bradley K. Smith whose telephone number is (571) 272-1884. The examiner can normally be reached on 10-6 Monday through Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Bill Baumeister can be reached on (571) 272-1722. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Brad Smith
Primary Examiner
Art Unit 2891